NORMANDALE COMMUNITY COLLEGE **3/19/2012**
COMMON COURSE OUTLINE
MATH 2520, CALCULUS 4: DIFFERENTIAL EQUATIONS WITH LINEAR ALGEBRA

I. EFFECTIVE DATE OF OUTLINE

Spring Semester, 2009. To be reviewed by the department annually.

II. CATALOG DESCRIPTION

A. MATH 2520
B. Calculus 4: Differential Equations with Linear Algebra
C. 5 Credits
D. Offered Fall and Spring Semesters
E. Prerequisite: MATH 1520 with a grade of C or higher, or approved equivalent preparation.
F. Matrices and systems, vector spaces, subspaces, linear independence, basis, dimension, linear transformations, eigenvectors; first and second order differential equations, Euler's Method, phase plane analysis of linear and nonlinear systems, extensive modeling. Possible topics from numerical methods, Laplace Transforms, power series solutions, or partial differential equations. Applications include – but are not limited to – science, engineering, economics, and ecology. Satisfies MnTC Goal 4.

III. RECOMMENDED ENTRY SKILLS/KNOWLEDGE

Students are expected to have mastered and retained the material covered in a standard first-year Calculus sequence: analysis of functions of one variable; analytic geometry; definition, development and application of differentiation and integration; infinite sequences and series. In addition, high-level problem solving ability will be assumed as well as mastery of algebraic manipulations, graphical visualization and numerical computations. Some familiarity with multivariable calculus (MATH 2510) will be helpful but not strictly required. To do well in this course, students should have excellent work habits and be dedicated to a complete understanding of concepts and their application.

IV. OUTLINE OF MAJOR CONTENT AREAS

A. Matrix methods for solving linear systems
B. Linear independence, basis, and dimension
C. Vector spaces, subspaces, and linear transformations
D. Determinants, eigenvalues, and eigenvectors
E. First order differential equations
F. Linear systems of differential equations
G. Nonlinear systems of differential equations
H. Topics from: Numerical methods; Laplace Transforms; power series solutions, or partial differential equations

V. LEARNING OUTCOMES

Upon successful completion of MATH 2520, students will be able to: (Letters in parentheses refer to student competencies of the Minnesota Transfer Curriculum, Goal 2–Critical Thinking, and Goal 4–Mathematical/Logical Reasoning.)

A. Apply matrix reduction methods to solve and describe solutions sets of linear systems. (2a,4b,4d)
B. Compute algebraically with matrices; products and inverses. (4b,4d)
C. Describe the structure and characteristics of vector spaces, subspaces, and linear transformations between vector spaces. (2c,4a,4b,4c)
D. Compute eigenvalues and eigenvectors. (4b,4d)
E. Classify and solve first order differential equations of various types: separable, exact, and linear. (2a,2b,4a,4b,4d)
F. Solve n-th order linear differential equations with constant coefficients using undetermined coefficients and variation of parameters. (4c,4d)
G. Analyze linear and nonlinear systems of differential equations using eigenvalue and phase plane methods. (2c,4b,4c,4d)
H. Model a variety of applied situations with differential equations (e.g. harmonic oscillator, predator-prey). (2a,2c,4a,4b,4d)
I. Approximate solutions to first-order systems using Euler's method. (4a,4b,4d)

VI. METHODS USED FOR EVALUATION OF STUDENT LEARNING

The instructor will choose from among various evaluation techniques including – but not limited to – in-class testing, take-home testing, assignments, quizzes, attendance, group or individual projects, and research. The instructor will also choose a method for end-of-the-semester evaluation.

VII. SPECIAL INFORMATION

Instructors will require some type of technology. This may include the use of one or more of a graphing calculator or computer algebra tools (such as the TI-89, MAPLE, Mathematica, or Wolfram Alpha).